9:00 a.m.

874-3 Assessment of Microvolt T Wave Alternans on and off Beta-Blocker Therapy

Pawel Ptaszynski, Thomas Klingenheben, Stefan H. Hohnloser, J.W. Goethe University Frankfurt, Frankfurt, Germany

Background: Microvolt level T-wave alternans (MTWA) is increasingly used for arrhythmia risk stratification in patients prone to malignant ventricular tachyarrhythmias and sudden cardiac death. Antiadrenergic therapy by means of beta blocker (BB) administration may influence MTWA assessment using exercise testing, mainly because patients may not achieve a sufficient increase in heart rate. However the effects of BB on MTWA assessment have not been prospectively studied.
Methods. Consecutive patients scheduled for ICD implantation underwent noninvasive MTWA assessment using bicycle exercise testing (spectral method; CH2000, Cambridge Heart Inc) on and off BB treatment in random order. Antiadrenergic therapy was withheld for at least 5 half lifes prior to the test off BB. Results of MTWA tests were compared using Fisher's exact test. Separate analysis was performed in a subgroup of patients who were on chronic amiodarone treatment.
Results: Sixty-six patients were included in the protocol. Of these, 17 were treated with amiodarone. Patients on BB had a resting heart rate of 71±10 bpm compared to 79±10 bpm of BB ($p<0.05$). The maximal exercise heart rate averaged 102±13 bpm to 107±13 bpm of BB ($p<0.05$). Whereas 13 pts (27%) tested MTWA positive on BB, the positivity rate was 47% (23 pts) off the drug ($p=0.05$).The prevalence of an indeterminate test result decreased from 41% to 24% ($p=0.09$). In the subgroup of patients with amiodarone, no patient tested MTWA positive, irrespective of the status of BB therapy. The proportion of indeterminate tests was 88% on and 82% off BB therapy exclusively due to chronotropic incompetence during testing.
Conclusion: MTWA assessment is facilitated by withholding BB prior to testing by reducing the prevalence of indeterminate tests as a consequence of insufficient heart rate increase. Chronic amiodarone therapy results in chronotropic incompetence in almost all patients which precludes exercise-based MTWA assessment.

9:15 a.m.

874-4 Hypertensive Stress Enhances Repolarization Heterogeneity

Bart Hooft van Huysduynen, Cees A. Swenne, Henk J. Ritsema van Eck, Anna L. Schoneveld, Hedde van de Vooren, Jan A. Kors, Piet Schiereck, Martin J. Schalij, Ernst E. van der Wall, Leiden University Medical Center, Leiden, The Netherlands, Erasmus University Rotterdam, Rotterdam, The Netherlands

Purpose: Several electrocardiographic indexes for heterogeneity of cardiac repolarization have been put forward: the QT interval, the QT-dispersion, the Tapex-Tend interval and singular value decomposition as a measure of the complexity of the T wave. Some postulate that the duration of longest action potentials are measured in the U wave. We studied the behavior of these alternative indexes under three different conditions; rest (R), normotensive gravitational stress (NORM) and hypertensive isometric stress (HYP).
Methods: Fifty-six healthy male volunteers participated. A continuous 12 lead ECG and blood pressure were recorded during R (sitting with horizontal legs), NORM (sitting with lowered legs at increasing angles) and HYP (sitting with horizontal legs while performing a 3-minute handgrip at 30% of the maximal force). In each volunteer a leg-lowering angle was sought at which the heart rate differed less than 10 % from the heart rate during handgrip. This succeeded in 41 subjects, who constituted the final study group.
Results: Heart rate increased from 63 ± 9 during R to 71 ± 11 bpm during both NORM and HYP. Systolic blood pressure was 122 ± 15 in R, remained 121 ± 15 during NORM and increased to 151 ± 17 mmHg during HYP. QT and QTc were larger during HYP (405 ± 27 and 433 ± 17 ms) than during NORM (389 ± 26 and 421 ± 18 ms, $P<0.001$). QT dispersion did not differ significantly between HYP (51 ± 26 ms) and NORM (45 ± 22 ms, NS). The Tapex-Tend interval in V2 was larger during HYP (125 ± 18 ms) than during NORM (117 ± 15 ms, $P<0.001$). The distance between the apices of the T and the U wave was significantly larger during HYP (191 ± 44 ms) than during NORM (158 ± 36, $P<0.001$). Fixed and moving window singular value decomposition indexes were larger during HYP (0.144 ± 0.071 and 0.075 ± 0.032) than during NORM (0.089 ± 0.053 and 0.048 ± 0.022, $P<0.001$).
Conclusion: Most measures put forward as indexes of repolarization heterogeneity were larger during hypertensive stress than during normotensive stress. Hypertensive stressors, like mental stress, are associated with arrhythmogeneity in vulnerable hearts. Our study provides one possible explanation for this, because hypertensive stress enhances repolarization heterogeneity.

9:30 a.m.

874-5 Optimal Prognostication From the 12-Lead ECG: Spatial Angle Between the QRS and T Wave Complexes

Takuya Yamazaki, Greg Engel, Clifton Watt, Jonathan Myers, Sung Chun, Victor F. Froelicher, VA Palo Alto Health Care System, Stanford University, Palo Alto, CA

Objective: To evaluate the prognostic value of a new criterion that combines measurements from repolarization and depolarization by considering the orientation of the QRS and T axis.
Methods: Analyses were performed on the first ECG digitally recorded on 46,950 consecutive patients at the Palo Alto Veterans Affairs Medical Center since 1987. Females and patients with paced rhythms, WPW, BBBs, IVCD, LVH, atrial fibrillation and diagnostic Q waves were excluded from all analysis, leaving 31,074 patients with a mean age of 55 years. Using computerized trigonometric algorithms, spatial QRS, T axis and T lambda (the spatial T-axis deviation from normal reference direction) were synthesized by deriving XYZ leads from the 12 leads using the inverse Dower weighting matrix and similarly by using the unadjusted amplitudes from leads I, aVF and V2. Spatial QRS-T angle was categorized into three groups: normal (0 to 50°), borderline (50 to 100°) and abnormal (100 to 180°). The main outcome measure was cardiovascular (CV) mortality.
Results: During a mean follow-up of 6 years there were 1,878 CV deaths. After adjusting for age and heart rate in a Cox regression model, spatial QRS-T angle difference was the most significant predictor of CV mortality, outperforming all other ECG findings including T wave and QRS amplitude and axis, T lambda, QRS duration, QT interval and dispersion and ST depression. Annual mortality was 0.6% for normal, 1.5% for borderline and 4.0% for the abnormal group. The borderline and abnormal groups each had a 34% step-increase in mortality. Similar results were found when Q waves, RBBB, IVCD, and LVH were included and considered in the model. The predictive significance remained when I, aVF and V2 were used to develop the spatial vector angles.
Conclusion: Spatial QRS-T angle is a significant and independent predictor of cardiovascular death providing more information than any other established ECG characteristics, and can easily be calculated as part of computerized ECG analysis.

ORAL CONTRIBUTIONS

875

Management of Atrial Fibrillation

Wednesday, March 10, 2004, 8:30 a.m.-10:00 a.m.
Morial Convention Center, Room 254

8:30 a.m.

875-1 Cardioversion in Patients With Dense Spontaneous Echo Contrast

Faisal O. Alatawi, Joseph Malouf, Chandrasekaran Krishnaswarmy, Saeed A. Al Ahmari, Brenda S. Moon, Charles J. Bruce, Naser A. Ammash, Mayo Clinic, Rochester, MN

Background:Dense spontaneous echo contrast (SEC) in left atrial appendage is associated with increased risk of thrombus formation. The risk of thromboembolism (TE) following electrical cardioversion is yet to be determined.
Methods: 133 patients (pts) mean age 72 ± *10* years, male 76.7% with non rheumatic atrial fibrillation (AF) 74%) or atrial flutter (FL) 26%, without mitral valve disease scheduled for Transesophageal Echocardiogram guided cardioversion between May 2000 to May 2003, were noted to have SEC .The SEC was described as less than mild in 75 pts 56.4% (group 1), severe in 58 pts (44.6%) group 2, The success and complication rates following cardioversion were analyzed.
Results: both groups were similar with respect to , age, gender, diabetes, hypertension and rhythm. Univariate comparitive analysis is summarized in the table below.

covariate	Group1 (n=75)	Group2 (n=58)	P value
AF / FL	53 / 22	46 / 12	0.3
History of TE (n)	1	7	0.009
History of congestive heart failure %	21%	53%	0.0001
LVEF(mean ±SD)	53 1±3	44.5 ±16	0.0008
Left atrial appendage emptying velocity (average of peak for 5 cycles) cm/s	46±16 (30 –62)	17±7 (10 – 24)	<0.0001
Successful cardioversion %	97	92	0.19
Post cardioversion thromboembolic events(n)	1	0	0.356

CONCLUSION: Dense spontaneous echo contrast in the left atrial appendage with very low LAA emptying velocity should not preclude from external biphasic electrical cardioversion. Dense spontaneous echo contrast carries similar success rate and thromboembolic risk as those with mild or less spontaneous echo contrast and high LAA emptying velocity.

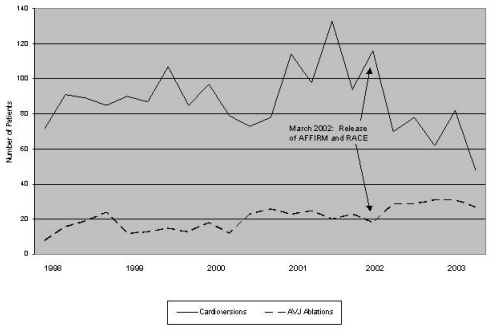
8:45 a.m.

875-2 Do Randomized Trials Affect Clinical Practice? AFFIRM, RACE, and the Management of Atrial Fibrillation

Pamela K. Mason, Mark A. Wood, Douglas Lake, John P. DiMarco, University of Virginia Health System, Charlottesville, VA, Medical College of Virginia, Richmond, VA

The impact of trials on clinical practice is often delayed. In 3/2002, the results of 2 randomized trials (AFFIRM and RACE) comparing rate control and rhythm control strategies in patients with atrial fibrillation (AF) were presented. Both studies reported no benefit with a rhythm control strategy with trends favoring a rate control approach. We hypothesized that these data would result in 2 changes in clinical practice: a decrease in elective cardioversions and an increase in atrioventricular junctional (AVJ) ablations in patients with AF. At the University of Virginia Health System, Charlottesville, VA and the Medical College of Virginia, Richmond, VA, we compared the numbers of elective cardioversions and AVJ ablations performed during the 52 months prior to the release of the AFFIRM and RACE trial data to the numbers performed during the 14 months after their release. There was a decrease in cardioversion frequency after the trials were presented. Between 1/1998 and 3/2002, an average of 31 elective cardioversions were performed each month, whereas between 4/2002 and 6/2003, 23 cardioversions were performed

monthly (p = 0.001). In contrast, AVJ ablations increased. During the same time periods, an average of 6 AVJ ablations were performed each month prior versus a average of 10 after the trial data were presented (p = 0.001).



We conclude that AFFIRM and RACE trial data resulted in an early change in the management of patients with AF at these 2 institutions with a shift in practice towards a rate control strategy.

9:00 a.m.

875-3 **Suppression of Paroxysmal Atrial Tachyarrhythmias: Results of the SOPAT Trial**

Monica Patten, Renke Maas, Bernd Lüderitz, Frank Sonntag, R. Hatala, M. Dluzniewski, G. Opolski, Thomas Meinertz, University Hospital Hamburg, Eppendorf, Hamburg, Germany

SOPAT is a prospective, double-blind, randomized trial to answer the following questions: 1. What is the average rate of spontaneous events of symptomatic atrial fibrillation (sAF)? 2. Does treatment with sotalol or quinidine + verapamil significantly reduce the recurrence rate of sAF? 3. How safe are these drugs?
Over 60 months 1033 pts. (mean age 60 yrs, 63% male, 12% heart failure) presenting at least one episode of sAF one month prior to enrolement were recruted in 171 centres in Germany, Poland and the Slovak Republic. Pts. were randomized to either 160 mg sotalol bid (262 pts.), 160 mg quinidine + 80 mg verapamil (Q+V) bid (263 pts.), Q+V tid (256 pts.) or placebo (252 pts.). Pts. received an ECG recorder (RhythmCard®, Instromedix) to record one 1-min ECG daily and in case of symptoms. ECGs were transmitted by telephone to a central analysis unit together with pts. symptoms. The primary endpoint was defined as the time to first recurrence of sAF or study discontinuation. Secondary endpoint was the number of days with AF. During the one year follow-up 296260 Tele-ECGs were transmitted and analysed.
The mean follow-up period was 233 ± 152 d. Premature study termination was highest in the placebo group with 59% vs. 41% under Q+V tid, and 42% under Q+V bid and sotalol. Regarding the primary endpoint all active treatments were superior to placebo and equivalent to each other. A total of 756 pts. reached the primary endpoint within 106 ± 9 d (mean ± SEM) under placebo, vs. Q+V tid: 150 ± 10 d (p= 0.0061), vs. Q+V bid: 149 ± 11 d (p= 0.0006), vs. Sotalol: 146 ± 9 d (p= 0.0007). Burden of sAF, determined as the relative number of days with sAF, was significantly reduced in all treatment groups compared to placebo (mean ± SD: 6.1 ± 13.5)vs. Q+V tid (3.4 ± 12, p=0.0001), Q+V bid (4.5 ± 12.3, p=0.008), and Sotalol (2.9 ± 6.5, p=0.026). A total of 6 deaths, 18 syncopes, and 1 ventricular tachycardia occurred with a comparable risk profile for all treatment groups.
In conclusion, treatment with Q+V is equivalent to sotalol in reducing the recurrence rate of symptomatic AF with a low risk of life-threatening events in pts. with lone AF or minimal structural heart disease.

9:15 a.m.

875-4 **The Incidence of Cerebral Embolism After Percutaneous Occlusion of the Left Atrial Appendage: A Serial and Prospective Study Using Cerebral Magnetic Resonance Imaging Scanning**

Heyder Omran, Harald Schmidt, Peter Bernhardt, Christoph Hammerstingl, Stephanie Kuntz-Hehner, Thorsten Sommer, Berndt Lüderitz, David Hardung, University of Bonn, Bonn, Germany

Background: Percutaneous left atrial appendage (LAA) occlusion has been introduced as an alternative treatment in patients with atrial fibrillation and increased thromboembolic risk. However, the long term risk of cerebral embolism under this new treatment is unknown. The aim of the study was to evaluate the long-term risk of cerebral embolism by serial cerebral MRI scanning.
Methods: 20 Patients with contraindications to warfarin or bleeding complications under oral anticoagulation were enrolled in the study. Serial neurological and echocardiographic examinations were undertaken prior to and during the procedure and in addition at 1 month, 2 months, 6 and 12 months. Cerebral MRI including diffusion weighted sequences was performed prior to the procedure, 48 hours after and 6 and 12 months after the procedure to assess for cerebral microembolism.
Results: Cerebral MRI performed prior to the occlusion procedure detected the presence of former cerebral embolism in 8 out of the 20 patients. Follow-up MRI studies excluded the presence of new cerebral microembolism in all patients. TTE and TEE examinations did not reveal de novo thrombus formation in the LA or thrombotic appositions on the surface of the occlusion device.
Conclusions: Long term follow-up of patients with occlusion of the left atrial appendage did not reveal cerebral thromboembolism on serial cerebral MRI. Percutaneous left atrial appendage occlusion is an alternative treatment in patients at high risk of thromboembolism and contraindications to oral anticoagulation therapy.

9:30 a.m.

875-5 **Randomized Trial of Two Antiarrhythmic Agents (Amiodarone and Sotalol) in Patients With Atrial Fibrillation for Whom Direct Current Cardioversion Is Planned**

Kunadian Vijayalakshmi, Michael J. Stewart, James A. Hall, Adrian Davies, Mark A. de Belder, The James Cook University Hospital, Middlesbrough, United Kingdom

Anti-arrhythmic agents enhance maintenance of sinus rhythm (SR) following direct current cardioversion (DCC) for atrial fibrillation (AF) but there are few comparative trials.
Aims: (1)To establish whether taking amiodarone or sotalol (at standard clinical doses) is better at achieving chemical cardioversion within the 6 weeks prior to planned DCC. (2)To establish whether DCC is more likely to be successful on an anti-arrhythmic agent and (3) to establish whether patients successfully cardioverted to SR are more likely to stay in SR over 6 months if taking a drug and if so to establish whether one agent is better than the other.
Methods: Randomised, prospective, non-blinded, controlled study of treatment with either amiodarone, sotalol or no anti-arrhythmic agent to start 6 weeks prior to DCC, and treatment to continue for a further 6 months. Patients with time of onset of AF within the last 1 year were included. 94 patients were enrolled in the study (nil group n=31, sotalol n=36 and amiodarone n=27). Follow up visits were at 6 weeks and 6 months post DCC.
Results: A total of 7 (25%) patients in the amiodarone group (A), 7 (19%) patients in the sotalol group (S) were chemically cardioverted to SR, compared to none (0%) in the no anti-arrhythmic group (N) [p=0.002 (AvN), 0.01 (SvN), 0.5 (AvS) respectively]. A total of 26/29 (90%) patients in the sotalol group were successfully cardioverted to SR compared to 15/20 (75%) patients in the amiodarone group and 23/31 (74%) patients in the no anti-arrhythmic group [p=0.03 (SvA), 0.05 (SvN), 0.9 (AvN) respectively]. At 6 month review 17 (62%) patients in the amiodarone group were in SR compared to 14 (38%) patients in sotalol group and only 5 (16%) patients in the no anti-arrhythmic group [p=0.05 (AvS), <0.05 (AvN) respectively]. Intention to treat and actually treated analysis gave similar results.
Conclusion: Treatment with either amiodarone or sotalol for 6 weeks had equal efficacy in achieving chemical cardioversion before planned DCC. Sotalol significantly increased the chance of DCC producing SR. After successful cardioversion, amiodarone significantly reduced the rate of reversion to AF and increased the chance of being in SR at 6 months

9:45 a.m.

875-6 **Early Recurrence of Arrhythmia Is Common in Patients Taking Amiodarone or Type IC Agents for Treatment of Atrial Fibrillation or Atrial Flutter**

Thomas H. Hauser, Duane S. Pinto, Mark E. Josephson, Peter Zimetbaum, Beth Israel Deaconess Medical Center, Boston, MA, Harvard Medical School, Boston, MA

Background: Amiodarone use for the prevention of recurrent atrial fibrillation or flutter requires drug loading over several weeks. The rate of recurrent arrhythmia during amiodarone loading has not been investigated. We compared the rates of recurrent arrhythmia in patients treated with amiodarone and type IC agents, which do not require drug loading.
Methods: We prospectively monitored a cohort of patients with ambulatory loop recorders during outpatient drug loading after spontaneous or electrical cardioversion to sinus rhythm.
Results: The study cohort comprised 339 patients who were treated with amiodarone (212), propafenone (64) or flecainide (63). Patients taking amiodarone were older (74 ± 11 vs. 59 ± 12, p <0.001) and more likely to have left ventricular dysfunction (80 [39%] vs. 8 [7%], p <0.001). Arrhythmia recurred in 106 (31.3%) and was persistent in 44 (13.0%). The incidence of recurrent arrhythmia at 15 days was much less in patients treated with amiodarone compared to those treated with a type IC agent (25.4% vs. 42.5%, p < 0.001) (Figure). Persistent arrhythmia was also much less in patients treated with amiodarone (9.9% vs. 19.2% at 15 days, p = 0.011). Of those with recurrent arrhythmia, 58 (55%) were asymptomatic.
Conclusion: Recurrent arrhythmia is common and frequently asymptomatic during drug loading with both amiodarone and type IC agents but is usually not persistent. The incidence of recurrent arrhythmia during drug loading is much less with amiodarone compared to type IC agents.